



C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF ARTS & HUMANITIES

SEMESTER: II

CODE: 4SC02FEN1

NAME: Functional English II

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
		Th	Tu	Pr	Total	Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC02FEN1	Functional English II	2	2	0	4	30	1	70	3	--	20	30	150

Objectives:-

- To train students in basic fundamentals skills of Communication – LSRW
- To train students in basic fundamentals skills of Communication – LSRW in English
- To provide students the value education for better society
- To make students able to communicate well in the Professional world

Prerequisites:-

- Students should have basic knowledge of English Language and grammar.
- Students should have ability to speak and write correct sentences in their day to day language.
- Students should be familiar with correct usage of language.

Course content:-

Sr. No.	Course Contents	Min. Hours
0	Prerequisites	02
	Part A: LSRW Skills	
1	Concepts of Grammar <ul style="list-style-type: none"> • Subject – Verb Agreement / Concord • Conjunctions • Conditionals • Causal Verbs • Active – Passive Voice • Direct – Indirect Speech • Common Errors in English 	14



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2	Comprehension Skills <ul style="list-style-type: none"> • Selected texts will be given to the students for reading. 	06										
3	Paragraph Writing <ul style="list-style-type: none"> • What is Paragraph? • Components of Paragraph – Unity, Topic Sentence, Cohesion, Coherence, Adequate Development • Approaches of Paragraph – Inductive , Deductive & Expository Approach • Types of Paragraph • Attributes of good paragraph • Use of Transitional Words • Expand the idea 	10										
4	Listening Skill <ul style="list-style-type: none"> • What is listening? • Difference between hearing & listening • Types of Listening • Traits of a good listener (During Lab hours only – Students will perform practical sessions by listening speeches delivered by sapient personalities)	08										
5	Speaking Skill <ul style="list-style-type: none"> • Students will present their views orally on the basis of understanding what they have read from the texts. Role Play Students will learn through role play <ul style="list-style-type: none"> • Students will be shown some role-play videos (two-three videos) • On the basis of role-play video observation students will perform character based role-play. 											
6	Vocabulary Building <ul style="list-style-type: none"> • Synonyms • Antonyms • One Word Substitute 	04										
7	Fusion- An Anthology of English Prose & Poetry Part-1 Prose:- <table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">1) A Letter</td> <td>Dhumketu</td> </tr> <tr> <td>2) Waiting for Death</td> <td>Damodar Mauzo</td> </tr> <tr> <td>3) An Astrologer's Day</td> <td>R. K. Narayan</td> </tr> <tr> <td>4) A gift of Maggie</td> <td>O' Henry</td> </tr> <tr> <td>5) Such Perfection</td> <td>R. K. Narayan</td> </tr> </table> Part-2 Poetry:-	1) A Letter	Dhumketu	2) Waiting for Death	Damodar Mauzo	3) An Astrologer's Day	R. K. Narayan	4) A gift of Maggie	O' Henry	5) Such Perfection	R. K. Narayan	18
1) A Letter	Dhumketu											
2) Waiting for Death	Damodar Mauzo											
3) An Astrologer's Day	R. K. Narayan											
4) A gift of Maggie	O' Henry											
5) Such Perfection	R. K. Narayan											



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	1) Photographing Mother	Sundram	
	2) Evening Song	Nalin Raval	
	3) Sonnet	William Shakespeare	
	4) The Road Not Taken	Robert Frost	
	5) Stopping By Woods on a Snowy Evening	Robert Frost	

Books Recommended:-

1. *A High School English Grammar*, **Wrenn & Martin**, S. Chand Publications
2. *An Intermediate English Grammar*, **Raymond Murphy**, Cambridge University Press
3. *Technical Communication : Principles and Practice*, **Meenaxi Raman and Sangeeta Sharma**, Oxford Press
4. *Contemporary Indian Short Stories, Series – I & II*, Sahitya Akademi, New Delhi
5. *Modern Gujarati Poetry: A Selection, translated by Saguna Ramnathan and Rita Kothari*, Sahitya Akademi (English Translation), New Delhi.
6. *Effusions: An Anthology of English Prose and Poetry*, ed. by **Marathwada University**, Oxford University Press, 1987
7. Expanding the idea: <http://komarajuvenkatavinay.wordpress.com-2009-07-10-how-to-write-do-proverb-expansion-or-exapnsion-of-an-idea/>



C. U. SHAH UNIVERSITY

FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: II

CODE: 4SC02COS1

NAME: Computational Skills (THEORY)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC02COS1	Computational skills	3	0	2	5	30	1	70	3	30	--	70	200

Objectives: -

Computer knowledge is very essential in each and every department. The course aims to provide ample computer knowledge to students in such a manner that it is useful in their future studies.

Prerequisites: - Student should have basic knowledge of computers, which would enable them to learn the course in a more effective manner.

Course outline:-

Sr. No.	Course Contents	No. of hours
1	Basic fundamentals of computer. Definition, characteristics, history, computer terminology, computer organization, input & output devices, storage devices (including latest devices), classifications of computers (including current computer systems), application of computers in lifescience, introduction to computer virus, problems associated with virus infection and its remedies	04
2	Windows Basic introduction. Operating Systems Definition, functions of an operating system, types of operating systems and their characteristics, difference between operating system and application Software. Basic Dos commands both internal and external.	04
3	MS Word: Word Essentials, the word workplace, Parts of MS Word screen, Typing	09



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	and Editing, Finding and Replacing, Autocorrect and Auto text, Reusing Text and Graphics, use of spell-check & grammar, thesaurus and scientific symbols, viewing of document by various ways Editing Tools, Formatting Text Formatting Text Character, Formatting Paragraphs, Formatting and Sorting Lists, Page Design and Layout, Page Setup : Margins, Page Numbers, and Other Items, Newspaper -style Columns, Working with Tables Creating and formatting of tables and sorting, merging etc. of data in tables. Inserting, deleting and sizing of rows and columns in tables, Opening, Saving and Protecting Documents, locating and Managing Documents Printing, Assembling Documents with Mail Merge, references.	
4	Ms Excel: Introduction to EXCEL worksheet, calculations in EXCEL. Hierarchy of operation, library functions such as logarithm, square root, standard deviation, sum, average, t-test, ANOVA etc. Drawing graphs in EXCEL line graph, histogram, pie-chart. –Editing chart features such as annotation, labeling of axis, changing legends etc.	09
5	MS PowerPoint Creating and viewing a presentation, adding animations and managing slides etc	04
6	Networking & Internet: Computer networks, networking technology, components of network. Internet – Basic terms, software and hardware requirement for internet, process of internetworking, internet tools, Email- components and working, study of biotechnological/microbiological/biochemistry web sites and search engines, searching through data bases, study of patent websites.	05
7	Introduction to the following software MS Paint, MS Access, Outlook, Adobe acrobat reader, Adobe Professional, Chemdraw, ISIS Draw, Nero Burning ROM.	04
8	Basic Biostatistics Introduction, Mean, Median; Standard error, Standard deviation, Variance.	06
Total Hours		45

Learning Outcomes:-

The course aims at providing the students ample knowledge of computational skills which shall be of use in their academic as well as professional life.



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Teaching & Learning Methodology:-

- Lectures will be conducted with the aid of multimedia projector.
- A combination of theory & practicals shall be conducted wherever possible to enable the students to understand the course in a more effective manner.

Books Recommended:

1. **Taxali R.K., P.C.** Software for Windows 98 made simple – 8th Edition – 2002 – Tata Mc, New Delhi.
2. **Guy Hart Davis**, WORD 2000, BPB Publications, New Delhi, 1999
3. **Joyce Cox**, MS Office: Step by Step, Prentice Hall of India, New Delhi, 2007
4. **Cornell**, Accessing and Analysing Data with MS EXCEL, Prentice Hall of India, New Delhi, 2007.
5. Manuals available with the software.

E-Resources:

1. <http://www.gcflearnfree.org>
2. <http://www.gcflearnfree.org>
3. <http://www.electricteacher.com/tutorials.htm>
4. <http://publiclibrary.cc/computerinternettutorial.htm>
5. <http://www.comptechdoc.org/basic/basicitut/>



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BACHELOR OF SCIENCE (BIOTECHNOLOGY)

SEMESTER: I

CODE: 4SC02COS1

NAME: Computational Skills (PRACTICALS)

Sr.No	Experiment
1	Exercises on word processing to execute various commands in preparing and editing documents.
2	Preparation of documents and implementing various formatting parameters in MS Word.
3	Working with footnotes and endnotes, referencing documents.
4	Working with auto-indexing, table and figure numbering.
5	Preparing and editing worksheets in MS EXCEL, Inserting formulas for different functions in MS EXCEL like sum, average, standard deviation, logarithm, square root etc.
6	Drawing various charts using experimental data.
7	Preparation of power point presentation with animation.
8	Working with internet browsing and using search engines.
9	E-mailing using address book and applying mail merge.
10	Surfing various educational web sites, online journals and patent search.
11	Use of Chemdraw to draw chemical structures.



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FACULTY OF SCIENCES

BACHELOR OF SCIENCE (BIOTECHNOLOGY)

DEPARTMENT OF CHEMISTRY

SEMESTER: II

CODE: 4SC02SOS1

NAME: Stereochemistry in organic synthesis (THEORY)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC02SOS1	Stereochemistry in organic synthesis	2	0	2	4	30	1	70	3	30	--	70	200

Objectives:

- The course will help the student to understand the basic mechanism behind various organic reactions.
- To assist students with basic knowledge of stereochemistry and explain how stereochemistry of a compound can affect reaction mechanism.
- To understand characteristic and application of chemical Kinetics.

Prerequisite: Students should have basic knowledge of organic chemistry.

Sr. No.	Course contents	Teaching Hours
1	General treatment of reaction mechanisms Ionic and radical reactions; heterolytic and, homolytic bond cleavage Reactive intermediates: carbocations (carbenium and carbonium ions), carbanions, carbon radicals, carbenes – structure using orbital picture, electrophilic/nucleophilic behaviour, stability, generation and fate. Reaction kinetics: transition state theory, rate constant and free energy of activation, free energy profiles for one step and two step reactions,	10



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	<p>Nucleophilic substitution reactions- SN1, SN2, SNi mechanisms. Effect of substrate structure, nucleophiles and medium on reactivity and mechanism; neighboring group participations.</p> <p>Elimination Reactions- E1, E2, and E1cB mechanisms. Saytzeff and Hofmann rules. Elimination vs substitution reaction. Electrophilic and Activated Nucleophilic substitution reactions of Benzene (Nitration, sulphonation, Halogenation and Friedel Craft reactions)</p>	
2	<p>Bonding and Stereochemistry of Carbon Compounds</p> <p>Concept of hybridisation, resonance (including hyperconjugation), inductive effect Huckel's rules for aromaticity & antiaromaticity. bond distance, bond angles</p> <p>Tautomerism: keto-enol tautomerism,</p> <p>Ionization of acids and bases: effect of structure, substituent and solvent on acidity and basicity.(Simple Aliphatic and aromatic Acids, Phenols and amines)</p>	10
3	<p>Stereochemistry Optical activity of chiral compounds: specific rotation, racemisation (general principle), resolution of simple acids and bases, Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations, Configuration: stereocentres: systems involving 1, 2, 3 centres, stereogenicity, chirotopicity. pseudoasymmetric (D/L and R/S descriptor threo/erythro and syn/anti nomenclatures ii) stereoaxis in C=C & C=N systems, cis/trans, syn/anti, E/Z descriptors. stereoselective and stereospecific reactions, chiral reagents, stereochemistry of biphenyls, allenes, and spirans – specification of their configuration.</p>	10
Total Hours		30



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Learning outcomes:

This course is designed to

- Deliver a detailed understanding of different types of bonding which are responsible for formation of compounds.
- Apply stereochemistry. It also makes them understand the impacts of stereochemistry in reaction.

Teaching & Learning Methodology:-

- Faculty member/s shall explain in a class room using black board and multimedia projector, charts, model, Student interaction, group discussion, seminar, quizzes, assignment, brain storming session, expert talks. etc.

Books Recommended:

1. **P. Sykes.** A Guide to Organic Reaction Mechanism.
2. **Arun Bahl and B. S. Bahl,**Advanced Organic Chemistry- S. Chand.
3. **S. Sengupta,** Basic Stereochemistry of Organic Compounds.
4. **I.L.Finar.** Organic Chemistry (vol.1&2).
5. **R. T. Morrison & R. N. Boyd:** Organic Chemistry, Prentice Hall.
6. **D. Nasipuri.** Stereochemistry of Carbon Compounds.
7. **E. L. Eliel,** Stereochemistry of Carbon Compounds- Tata McGraw Hill.
8. **T. W. Graham Solomons:** Organic Chemistry, John Wiley and Sons.

E-Resources:

1. <http://organicchemstudysite.tripod.com/alkanes.html>
2. https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=12&cad=rja&ved=0CHEQFjAL&url=http%3A%2F%2Fww2.chemistry.gatech.edu%2Fclass%2F1315%2Fweek%2FChapter2.pdf&ei=H3hiUd_SDMWHrAfH5YDwCw&usg=AFQjCNFsNITqdT8gutjM8io_I8tG8Hg6Mg&bvm=bv.44770516,d.bmk
3. <https://en.wikipedia.org/wiki/Alkyne>
4. <http://www.learnersplanet.com/aminesphenolsbenzeneorganic-compounds#.UWJ4rBdHKxA>
5. <http://en.wikipedia.org/wiki/Stereochemistry>
6. <http://www.colby.edu/chemistry/OChem/STEREOCHEM/>



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7. <http://research.cm.utexas.edu/nbauld/teach/stereo.html>
8. http://en.wikipedia.org/wiki/Chemical_kinetics
9. <http://www.chem.arizona.edu/~salzmanr/480a/480ants/chemkine.html>
10. <http://www.science.uwaterloo.ca/~cchieh/cact/c123/chmknets.html>



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DEPARTMENT OF CHEMISTRY

SEMESTER: II

CODE: 4SC02SOS1

NAME: Stereochemistry in organic synthesis (PRACTICALS)

1. Experiments on surface tension and viscosity, partition coefficient, adsorption, order of reaction (First and Second), refractive index, optical activity (polarimetry) should be covered.
2. Organic synthesis of few common compounds



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DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: II

CODE: 4SC02PPH1

NAME: Plant physiology (THEORY)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			Total marks
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW		Pr
4SC02PPH1	Plant Physiology	2	0	2	4	30	1	70	3	30	---	70	200

Objectives: -

The objective of this course is to familiarize the students with the fundamental concept of tissue system and anatomical structure of higher plants.

Prerequisites:-

- Ability to understand the concepts of biology.

Course outline:

Sr. No.	Course Content	No. of hours
1	Water in relation to plants – Physical properties of water, Absorption of water – Physico-chemical processes, plant cell as Osmotic system – plasmolysis – significance and practical application. Soil water – Mechanism of water absorption & factors affecting absorption of water. Macro & Micro Elements. Mineral uptake – passive (ion exchange theory) and active (carrier concept) Ascent of Sap Path of movement of Sap – Evidences – mechanism – theories. Transpiration – Types – structure of stomatal complex – Mechanism of stomatal movement. Factors affecting Transpiration, Significance of guttation, Hydathodes.	10
2	Plant Metabolism - A- Photosynthesis- Introduction, photosynthetic apparatus, photosynthetic pigments, ultrastructure of chloroplast, Photo-phosphorylation, Light reaction, Calvin's cycle, C3-plants, C4 plants, C4-pathway, CAM pathway, CAM-plants, photorespiration and its significance. B - Translocation of organic solutes. Mechanism of phloem transport, Mass flow	10



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	hypothesis, protoplasmic streaming theory.	
3	Respiration - Introduction, mitochondrion as a respiratory centre. Types of respiration - Aerobic and anaerobic respiration, Krebs cycle. Alcoholic and lactic acid fermentation.	10
Total Hours		30

Learning Outcomes:-

The course provides knowledge of the most fundamental concept in life, i.e: “the cell”, which helps in understanding the concept of life on earth.

Teaching & Learning Methodology:-

- Use of multimedia, charts and models.
- Student interaction, group discussion, seminar, quizzes, assignment, brain storming session, expert talks.

Books Recommended:

1. **Gerall Karp**, Cell and Molecular Biology.
2. **P.K Gupta**, Cell and molecular biology, Rastogi publication.
3. **Prof. H. Srivastava**, Plant Physiology and Biochemistry, Rastogi Publications.
4. **R. M. Devlin and F. H. Witham**, Plant Physiology, CBS Publishers.
5. **C. P. Malik & A. K. Srivastava**, Text Book of Plant Physiology, Kalyani Publishers.
6. **Bruce Alberts**. The Cell.
7. **Cooper**, The cell (A Molecular Approach)

E-Resources:

1. biology.uco.edu/bidlack/botany/notes.htm
2. www.liqwidmindz.com/LifeSciences/Botany.htm
3. www.bscnotes.gurukpo.com/
4. www.quizlet.com/subject/botany-notes/
5. www.cellbionotes.net/
6. www.sparknotes.com > SparkNotes



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DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: II

CODE: 4SC02PPH1

NAME: Plant physiology (PRACTICALS)

Sr.No	Experiment
1	Osmosis by egg membrane and potato osmoscope.
2	Study of Plasmolysis
3	Effect of different conc. of organic solvents on membrane permeability
4	Determination of water potential of any tuber
5	Study of stomatal types.
6	Determination of stomatal number.
7	Determination of stomatal index.
8	Separation of chloroplast pigments by paper chromatography
9	Demonstration of Hill reaction
10	Effect of different intensities of light on photosynthesis
11	Effect of different colors of light on photosynthesis
12	To compare the rate of transpiration from two surfaces of a leaf by Bell Jar method.
13	To determine the path of water (ascent of sap)
14	To determine R.Q. using different substrates.



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DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: II

CODE: 4SC02CMB1

NAME: Cell & Molecular Biology (THEORY)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
						Theory				Practical			
		Th	Tu	Pr	Total	Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC02CMB1	Cell & Molecular Biology	6	0	6	12	30	1	70	3	30	--	70	200

Objectives: -

- The course aims at providing adequate knowledge about basic concepts of cell.

Prerequisites:-

- Basic knowledge of biology is required.

Course outline:

Sr. No.	Course Content	No. of hours
1	Introduction to cell: History, evolution of cell, Cell as the basic unit of life, cell theory, Classification of cell types. Cellular organization of prokaryotes and eukaryotes.	10
2	Ultra structure of cells - sub-cellular organization - structure and function of cell membranes, cytosol / Endoplasmic reticulum, golgi bodies, nucleus, cytoskeleton (Microtubules, microfilaments), ribosomes, mitochondria and chloroplast, vacuoles, peroxisomes, lysosome, cell wall, structure of cilia and flagella.	15
3	Cell division (Eukaryotic and Prokaryotic) - mitosis, meiosis and cell cycle. Cell cycle and its regulation. Brief overview of cancer and apoptosis.	15
4	Chromosome: Morphology, organization, ultrastructure of Centromere and Telomere; Chromosomal alterations- deletions, duplications, translocations, inversions; Variations in chromosome number- aneuploidy, polyploidy; sex chromosomes and sex determination.	15
5	Genetic code, DNA Replication, Theta model and Rolling circle model.	12



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	DNA Repair: Causes and mechanism–photo reactivation, excision repair, mismatch repair, SOS repair.	08
6	Transformation, conjugation and transduction. Transcription: Transcription of RNA in prokaryotes and eukaryotes. Steps in transcription. Maturation and processing of RNA. Translation: Post translational processing of proteins.	15
Total Hours		90

Learning Outcomes:-

- At the end of the course the student would have gained sufficient knowledge in order to study the courses offered in the higher semesters.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.

Books Recommended:

1. **Allyn Bregman**, Laboratory investigation in cell and molecular biology. John Wiley & sons. 1996.
2. **S.S Purohit**, Biotechnology, Fundamentals and application, Agrobios.
3. **P.K Gupta**. Biotechnology. Rastogi publications.
4. **Harvay Lodish, David Baltimore, Arnold Beek, Lawrence Zipursky, James Darnell**. Cell and Molecular biology.
5. **P.K Gupta**. Cell and molecular biology. Rastogi publication.
6. **De Robertis**: Cell and Molecular Biology
7. **Peter J. Russel**. Genetics.
8. **Karp. G.** Cell & molecular Biology , 3rd Edition John Wiley & Sons; INC. 2002.
9. **Bruce Alberts**. The Cell.
10. **Cooper**. The cell (A Molecular Approach)
11. **Verma**. Cell biology, genetics, molecular biology, evolution and ecology. 2006.
12. **Walker J.M and Giggled, E.B.** Molecular Biology & Biotechnology (Indian Edition) Royal Society of Chemistry U.K. 1983.

E-Resources:

1. www.cellbio.com/
2. mcb.asm.org/
3. www.mun.ca/biology/desmid/brian/BIOL2060/CBhome.html
4. pirate.shu.edu/~changsul/pdf/cellnotes.doc



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DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: II

CODE: 4SC02CMB1

NAME: Cell & Molecular Biology (PRACTICALS)

S.No	Experiment
1	Determination of cell count (Haemocytometer).
2	Preparation and study of mitosis slides from buccal mucosa and onion root tips by squash method.
3	Preparation and study of meiosis slides from meristem tissue by squash method.
4	Preparation of stains & staining reagents.
5	Staining of cell structures.
6	Determination of total count of RBC.
7	Determination of total count of WBC.
8	Determination of Differential count of WBCs
9	Determination of percentage viability of cells.
10	Isolation of DNA from Cauliflower.
11	Isolation of RNA from Yeast.
12	Estimation of DNA by DPA method.
13	Estimation of RNA by Orcinol method.
14	Replica plate technique
15	Preparation of models.



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DEPARTMENT OF BIOTECHNOLOGY

SEMESTER: II

CODE: 4SC02BPH1

NAME: Biophysics (THEORY)

Teaching & Evaluation Scheme:-

Subject Code	Subject Name	Teaching Hours/week				Evaluation scheme/Semester							
		Th	Tu	Pr	Total	Theory				Practical			Total marks
						Sessional Exam		University Exam		Internal		Univ	
						Marks	Hrs	Marks	Hrs	Pr	TW	Pr	
4SC02BPH1	Biophysics	3	0	0	03	30	1	70	3	---	----	-----	100

Objectives: -

- The aim is to introduce the physical aspects and bioenergetics of the living system.

Prerequisites:-

- Basic knowledge of biology is required.

Course outline:

Sr. No.	Course Content	No. of hours
1	Biophysics of Water: Molecular structure of water, hydrogen bonds and physical properties of water.	5
2	Fundamentals of thermodynamics- endergonic and exergonic processes, enthalpy, entropy, activation energy, free energy change, phosphoryl transfer reaction, oxidation reduction reaction, redox potential, equilibrium and non equilibrium thermodynamics, high energy compounds, causes of energy richness in ATP.	10
3	Bio-energetic: Laws of thermodynamics (1st & 2nd laws), electrical properties of biological compartments; electrochemical gradients, membrane potential, chemiosmotic hypothesis.	10
4	Biophysics of Photosynthesis Primary events in photosynthesis, light harvesting pigments, resonance energy transfer in photosynthetic pigments, fluorescence and phosphorescence, absorption spectra and action spectra of photosynthetic pigments, photosynthetic reaction center and accessory pigments, light reception in microbes, plants and animals.	10
5	Metabolic pathways: Basic concept & design, glycolysis, TCA cycle, Pentose phosphate pathway, gluconeogenesis & glycogen metabolism.	10
Total Hours		45



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Learning Outcomes:-

- The students will be able to understand the fundamentals of biophysics.

Teaching & Learning Methodology:-

- Use of audiovisual aids.
- Use of charts.
-

Books Recommended:

1. **R N Roy**. A Textbook of Biophysics. New central Book Agency Pvt. Ltd, Calcutta.
2. **S.Thiruvia Raj**. Biophysics. Saras Publications, Tamilnadu.
3. **Volkenstein, M.V** Biophysics.
4. **Martin** Introduction to biophysical chemistry.

E-Resources:

1. www.biophysics.org
2. www.mednotes.net/notes/biophysics/